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Alaska's HAARP facility opens gates to community

by 1st Lt. Morgan J. O'Brien and 2nd Lt. J. Elaine Hunnicutt, AFRL Public Affairs

GAKONA, Alaska — Scientists and engineers of the High-Frequency Active Auroral Research Program near Gakona, Alaska, opened their doors to more than 100 guests for the seventh open house of the largest Department of Defense facility of its kind Sept. 28 and 29.

"On the street, off the Internet, and through our hotline, we get many inquiries about the activities we are involved in here," said Ed Kennedy, the Navy's program manager for HAARP. "In our opinion, a hands-on open house is the best way to interact and tell people the story about HAARP."

HAARP is a joint Air Force and Navy program. Its scientific research is coordinated with and largely conducted by academia.

Visitors were invited to tour the facility, take photographs and ask questions. The primary focus of this year's open house was to explain the process for completing the

continued on page 2

Near Gakona, Alaska, HAARP antennas stand 65 feet high and are spaced 80 feet apart in eight columns by six rows. With a slated completion date of 2006, the array will consist of antennas aligned in 15 columns by 12 rows. The instruments study the effects of naturally occurring anomalies in the Earth's ionosphere that sometimes disrupt communication, navigational and power grid systems—such as region-wide electrical production networks. (Air Force photo by 2nd Lt. J. Elaine Hunnicutt)

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http://extra.afrl.af.mil/news/index.htm

HAARP from page 1

facility. Currently, the facility is approximately one-fourth complete with 48 of 180 antennas in place and functional.

"The purpose of the open house is in line with the importance HAARP places on reaching the people of the surrounding area," said Dr. Paul Kossey, the Air Force program manager for HAARP. "Through open houses and community outreach to the schools, we want the public to be familiar with the science of our site because it helps them understand what we do here and become more comfortable with the program."

The facility studies the effects of naturally occurring anomalies in the Earth's ionosphere that sometimes disrupt communication, navigational and power grid systems—such as region-wide electrical production networks.

"It is important that our work is not confined to the scientific community," said Cornell University's Dr. Elizabeth Gerken, a presenter at the open house who has given speeches to a Gakona-area high school.

The HAARP facility is comprised of a large radio frequency antenna array and diagnostic equipment designed to reproduce, characterize and understand natural phenomena similar to those that occur naturally in the ionosphere and space.

The antenna array radiates 960,000 watts of radio frequency energy into the ionosphere; the upper portion of the Earth's atmosphere that extends spaceward 50 to more than 300 miles. Upon completion, the array will produce 3.6 megawatts of radio frequency energy.

The simulated phenomena, which can only be observed with sensitive diagnostic equipment, provide scientists and engineers with insights to better understand how these naturally occurring phenomena occur and the effects they produce on communication, navigation and radar systems.

"Through our research, we hope to one day predict patterns in the ionosphere 24 to 48 hours out, to help the warfighter prepare for communications outages caused by action in the ionosphere," said 2nd Lt. Dave Armbruster, a HAARP deputy program manager.

DoD owns the 5500 acres that is home to HAARP. The HAARP antennas are 65 feet high and spaced 80 feet apart in eight columns by six rows. With a slated completion date of 2006, the array will consist of antennas aligned in 15 columns by 12 rows.

"This weekend allowed us to share the global reach of the HAARP program," said Navy Ensign Noah Reddell, an engineering student at Stanford University, currently involved in a project related to HAARP, in which a remote buoy will be deployed between New Zealand and Antarctica. "This program is not confined to the local area."

The ionosphere and radio science research facility is located 200 miles northeast of Anchorage, near mile 11 on the Tok Highway.

"What we are doing is similar to DARPA's creation of the Internet, or the Air Force's development of global positioning satellites," said Kossey. "Today, radio science is not glamorous, still the military funds basic research in this area because of its importance to navigation, radar and communication systems.

"We're a 'tech push' facility," said Kossey, "HAARP assesses the viability of new system concepts for the next generation of these systems. After gaining understanding of areas that will help the military in the near term, our research and insights will be filtered to the commercial sector allowing them to run with it." @

Equipment recycling enhances university research

by Rex Swenson, Munitions Directorate

EGLIN AIR FORCE BASE, Fla. — Q: What do you get when you cross university students with military surplus scientific equipment? A: Smarter students at very little cost to the university.

Using a special program known as an Educational Partnership Agreement (EPA), the Air Force Research Laboratory Munitions Directorate at Eglin Air Force Base, Fla., donated some surplus scientific equipment to the University of West Florida (UWF).

During a Gulf Coast Alliance for Technology Transfer (GCATT) quarterly board of directors meeting, in 2001, Dr. William Huth, the Associate Vice President for Research and Graduate Studies at UWF first learned of the technology transfer mechanisms.

Munitions Directorate environmental scientist, Mitch Bogle, explains the finer points of metallurgic analysis to UWF chemistry major, Sara Anastasio, during a recent visit to the university to set-up and calibrate the equipment, which had been donated through the Education Partnership Agreement. (Air Force photo by Rex Swenson)

"The Munitions Directorate had some surplus equipment that was going to be sent to the Defense Reutilization Marketing Office," explained Mr. Allen Geohagan, a support contractor with MN who administered the EPA. "Now the equipment is being put to good use by students at UWF, instead of being scrapped."

According to the Educational Partnerships portion of the US Code, "Under a partnership agreement entered into with an educational institution, the director of a defense laboratory may provide assistance to the educational institution by transferring to the institution defense laboratory equipment determined by the director to be surplus."

Geohagan, who was instrumental in working the equipment transfer for the Air Force, explained further, "These Education Partnership Agreements are designed to allow the director of a defense laboratory to enter into an EPA with an educational institution to encourage and enhance study in scientific disciplines at all levels of education."

"Once we got it to the laboratories, we had an expert reassemble and calibrate the scanning electron microscope and other equipment, explained Dr. George Stewart, Chairman of the UWF Biology Department.

Geohagan and Mitch Bogle, an environmental scientist at MN, recently visited the university to tour the science department and see the equipment in action. While there, Bogle calibrated and demonstrated a piece of equipment used for metals analysis known as the X-Ray Fluorescence Spectrometer.

Since Bogle's demonstration, the XRF instrument has been used in the Instrumental Analysis course taught by Dr. Lois Dixon. Seven students, senior chemistry majors, have performed analyses on samples and objects selected by the students.

Samples included coins from different periods, medals, ores, glass objects, jewelry, and alloys. The students were required to submit reports, which included the theory, methodology and results.

According to Dixon, "The instrument works well and the experiments have been very successful. The students are particularly pleased to be able to analyze real world samples both accurately and rapidly."

Another instrument MN donated was a liquid scintillation spectrometer, which is used by the UWF Biology department to measure low levels of alpha radiation in uptake studies of marine life.

Biology professor Phillip Ryals was very excited about the Scanning Electron Microscope. "This equipment continues to provide students and professors with research opportunities unavailable prior to its donation," Ryals said.

Phil Conklin, a UWF faculty member who has more than 20 years with the Chemistry Department said of the donation, "Prior to getting this electron microscope we were held back by the limited capability of our equipment, but now this will open up new avenues of research."

Conklin added that both biology and chemistry students now use the infrared spectrometer, which has been co-located between the organic chemistry and biology laboratories. "This piece of equipment will allow students to gather research data from their samples in under five minutes," Conklin said.

According to Dr. Stewart, "This is tremendously useful equipment and will continue to broaden the horizons in not only student research, but research performed by faculty members as well." @

Advances in high-temperature composites leads to bleed air duct cover solution

by Timothy R. Anderl, Materials and Manufacturing Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Materials research scientists and engineers from the Air Force Research Laboratory's Materials and Manufacturing Directorate designed and prototyped a new polyimide cover for B-1B bleed air ducts. The ducts connect the aircraft's engine bleed air to a heat exchanger, and the cover is critical to keeping volatile fluids from reaching a duct's hot surface, a situation that could prove catastrophic to flight operations.

Ogden Air Logistics Center, Hill Air Force Base, began manufacturing and producing the air duct covers at their high-temperature capable production facility in January 2003. The B-1B System Program Office (SPO) plans to place the parts on the aircraft on-site as they are delivered, so the project could be complete by July 2004.

"Breakthroughs in high-temperature polymer matrix composites, and a legacy of applying advanced composite technology to solve aircraft structural and service life challenges, allowed (researchers in the directorate's Advanced Composite Office, Hill Air Force Base, Utah, and Structural Materials Branch, Wright-Patterson Air Force Base, Ohio) to quickly design an air duct cover to replace the older cover, which was degrading in the B-1B's high-temperature environment," said Dr. Katie E. Thorp, a scientist from the Structural Materials Branch.

The basic construction of a B-1B bleed air duct includes a metal duct structure, which is surrounded by a layer of insulation. Surrounding the insulation layer is a polymer composite shell made with a polyimide resin. Air flowing through the ducts regularly reaches temperatures between 800 and 1,200 degrees F. "The shell is essential to safe operation of the aircraft because it keeps volatile fluids separated from the duct's hot surface," said Lawrence L. Coulter, chief of the Air Force Advanced Composites Office.

According to Coulter, engineers from the B-1B SPO at Tinker Air Force Base, Okla., first contacted ACO in August 2003 after they noticed that resin in the cover was deteriorating. This caused a problem for aircraft maintainers because there was no repair procedure for the polyimide cover and they were forced to condemn and replace any duct in this poor condition. In each of the B-1B's four engines there are two bleed air ducts, so replacing degraded air ducts quickly became a very costly problem.

After consulting with colleagues from the directorate's Nonmetallic Materials Division, engineers at the ACO, suggested that Air Force resin (AFR-PE-4) had material characteristics that qualified it as a candidate replacement for the degrading polyimide material, Coulter said. AFR-PE-4, another polyimide class material, is light weight and has thermal oxidative stability, which keeps it from degrading at the elevated temperatures it will encounter in this application.

Frank A. Bruce, an engineer from ACO, traveled to the directorate's Wright-Patterson Air Force Base, location to receive technical guidance, and hands-on experience with the AFRPE-4 material and its processing techniques. Using specific technical data gathered during collaboration with the Nonmetallic Materials Division, ACO experts designed a new duct cover, which was completed in November 2001. In addition, an ACO engineer met with maintainers on the flightline to discuss application of the new duct cover, and scale up and transfer to the production facility at Ogden Air Logistic Center was completed in November 2002, he added.

The B-1B SPO authored instructions, which were reviewed by engineers at ACO. The instructions will enable Air Force maintainers to apply the new covers as a field level repair during the B-1B's regular maintenance intervals. The Air Force currently has 60 B-1B aircraft in its fleet. @

IF Directorate sponsors Digital Forensics Workshop

by Fran Crum, Information Directorate

ROME, N.Y. — Digital forensic researchers from five nations collaborated during the 3rd Annual Digital Forensic Research Workshop, sponsored by the Air Force Research Laboratory's Information Directorate Aug. 8 in Cleveland, Ohio.

Attendees included representatives from the military, law enforcement and academia in Italy, England, Australia, Ireland, and the U.S. Highlighting the event were panel discussions on digital forensic law and digital forensic tools and technology and an exhibition of current research accomplishments.

"By bringing academic researchers and digital forensic investigators and practitioners together in active discussion, the workshop made major contributions in defining the need and creating the processes for incorporating a rigorous scientific method as a fundamental tenet of the evolving discipline of Digital Forensic Science," said Glen E. Bahr, a workshop organizer with the directorate's Defensive Information Warfare Team.

"Advancements were made in developing a research agenda that emphasizes practitioner requirements, multiple investigative environments and real world usability," Bahr said. "Discussions were also conducted on achieving discovery, explanation and presentation of conclusive, persuasive evidence that will meet the heightened scrutiny of military decision-makers and civilian courts."

"Computers have become ubiquitous -- not only in home and business activities, but also in terrorism, war and crime," Bahr said. "Captured computers contain a wealth of information about the perpetrators' activities, contacts, relationships and locations. Rapid and reliable mining of these data for investigations of digital "wrongdoing" from all perspectives is invaluable to military response, Homeland Security, and law enforcement actions." @

AFRL technology leads to first Snell-approved display system in commercial safety helmet

by Amy Hill, Ball Aersospace & Technologies Corp.

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Recreational and professional activities like auto racing, motorcycling, and skiing incorporate speed, agility, and a head—making helmets one of the most effective means of preventing injury, permanent disability, or death.

Recently, the Human Effectiveness Directorate's Crew System Interface Division enhanced the capability of a protective helmet in the racing arena. The directorate's anthropometry expertise, data, and models resulted in the first Snell safety-approved integration of a display system into a BMW Formula 1 racing helmet. Snell is known for its work in setting, maintaining and upgrading the most authoritative helmet standards in the U.S. and throughout the world.

The display system was developed by BMW Group's California-based subsidiaries Palo Alto Technology Office and Designworks USA. However, the Air Force Research Laboratory was requested to find a solution for locating the display within the system as well as to assist in helmet sizing. Anthropometry expertise in the directorate's Human Technology Interface Branch, particularly that of Kathleen Robinette, was an integral part of the project. In fact, Soren Peterson of Designworks USA, a subsidiary of BMW, reported that the explanation of the 3-D anthropometry data from Robinette helped bring about the safety approval by Snell.

The Snell-approved safety helmet demonstrates the Human Effectiveness Directorate's success in collaborating with industry, improving protective equipment, and increasing the potential for integrating display systems in motorbike helmets in the future—a possible benefit to helmet users around the world. @

MN partners with Eglin for S&E Immersion Program

by Lt. Col. Mark Koch, Munitions Directorate

EGLIN AIR FORCE BASE, Fla. — Air Force Research Laboratory junior scientists and engineers (S&Es), both military and civilian, bring strong science and engineering skills to their jobs.

Often, first assignment S&Es have a limited understanding of how technology they develop will be operationally employed. The advent of "technology to warfighting" as an Air Force core competency has reinforced the need for AFRL employees to increase their knowledge of the operational environment. To give junior S&Es the operator's perspective, the Air Force Research Laboratory Munitions Directorate (AFRL/MN) recently partnered with other Team Eglin units to start a program called the Scientist and Engineer (S&E) Immersion Program.

The objectives of the Scientist and Engineer Immersion Program are two-fold: Familiarize junior scientists and engineers with operational considerations aircrews must fully understand to successfully employ weapons and return unharmed; and develop working relationships at the action officer level in the user community. This program, while obviously beneficial in the short term, will also imbue the technology leaders of tomorrow's Air Force with an operational context for guiding the development of future warfighting capabilities.

Because Eglin physically brings together specialties ranging from scientific research to developmental and operational testing to actual warfighting, opportunities to increase "technology to warfighting" are limited only by one's imagination and motivation. The 85th Test and Evaluation Squadron readily jumped in to help. Capt. John Wilbourne and Capt. Mike Kensick, of 85TES, created a course of instruction to familiarize junior AFRL S&Es with both air-to-air and air-to-ground operations. It might sound easy to develop a curriculum covering something so familiar to the instructors, but a big concern was ensuring the pilots and engineers started from common ground and spoke a "common language." After all, tactics discussions and rules of engagement are not normal lunchtime conversation in the lab. Wilbourne and Kensick spent several weeks of their free time working around a heavy schedule of real-world taskings, to refine the curriculum for initial presentation. The 33rd Fighter Wing also participated by evaluating different venues to expose S&Es to a simulated operational environment. Due to real-world commitments, the 33FW had to postpone their participation.

So far 25 junior scientists and engineers have taken part in the S&E Immersion Program. Feedback from both the S&Es and the operational community has been very positive with both groups learning from the other. AFRL/MN currently plans to require all junior military and civilian S&Es to participate in the program as an in-processing requirement.

The curriculum is straightforward. The program takes the participants through a mission-planning scenario using typical rules of engagement and tactics for a current strike package (both air-to-air and air-to-ground) against a representative integrated air defense system. The instructors also discuss with the participants what areas could be improved to reduce workload, increase lethality and/or improve survivability. In the future, the program will hopefully be expanded to include observation and hands-on simulator time at the 33FW Mission Training Center. Additionally, AFRL/MN is working with the 46th Test Wing to get the junior S&Es exposure to the developmental test business, providing them a better appreciation for how technology gets from the bench to the field and what pitfalls systems might face due to unanticipated design problems. Further, the 46TW will show the students much of the "back shop" support normally found in an operational unit, furnishing the S&Es a first hand look at how design decisions may have unanticipated consequences on reliability, availability, and maintainability. Finally, in an effort to strengthen its relationship with the user community, AFRL/MN also plans to add an aspect to the S&E Immersion Program where all the Team Eglin partners involved in the joint venture will receive information on how the lab works and what it is doing. To gain a better understanding of how technology ideas make it to the field, other Team Eglin members will see how programs like Massive Ordnance Air Blast were executed as well as seeing some projects still in the concept pipeline. @

Net Index

Due to the number of submissions we receive, some sections of *news@afrl* are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

L@b L@urels

Roundups

To view the full text of these and other articles visit the *news@afrl* page on the Internet at http://extra.afrl.af.mil/news/index.htm.
To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

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- **Old Crows group honors Sensors people**
- **Two from VA recognized with Hispanic Achievement awards**
- **SN engineer named Mowhawk Valley leader**
- **AFRL awards $1.8M contract to Canandaigua firm**
- **AFRL research seeks advanced translation capabilities**
- **Rome awards $21.5M contract to Boeing Satellite Systems**

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ML firefighters demonstrate latest technologies

TYNDALL AIR FORCE BASE, Fla. — Senior Airman George McFadden and Airman Dustin Wilds, 325th Civil Engineer Squadron firefighters, assisted in extinguishing a live jet fuel pit fire at Tyndall Air Force Base, FL, during an Air Force Research Laboratory technology demonstration August 21. The AFRL Airbase Technologies Division, or MLQ, demonstrated their First Responder Expeditionary fire truck which combines a foam and high-pressure water system for Dr. Charles Browning, Dr. Barry Farmer, and Col. Timothy Sakulich, all of the Materials and Manufacturing Directorate; Dr. Hamish Fraser, Ohio State University; and Dr. Rita Oberle, Georgia Institute of Technology, during a two-day tour of the Tyndall AFRL facilities. (Air Force photo)